

## Prediction of Academic Achievement by Cognitive and Socio-emotional Variables: A Systematic Review of Literature

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### Abstract

The purpose of the study was to examine the scientific production about the prediction of academic achievement by means of cognitive and socio-emotional variables through a systematic literature review involving empirical articles. The search was carried out in the SciELO, Pepsic and Capes journal databases, covering the period from 2008 to 2018. Twenty six articles that met the pre-established inclusion criteria were analyzed. Intelligence was the most frequent variable in the studies ( $n = 7$ ) and explained between 1.21% and 43% of school achievement. Some socio-emotional variables had greater predictive power than intelligence: self-regulation (49 to 90%), satisfaction with the learning process (79.21%), self-efficacy (2.56 to 44.89%) and learning engagement, 6.76 to 44.89%). Based on the literature, we can conclude that academic achievement is multi-determined, with influence from different cognitive and socio-emotional variables. Future studies need to consider the use of standardized achievement measures to enhance comparability, as well as to construct models with multiple variables and their correlations for the sake of a deeper investigation of the impacts of these relationships on achievement along the school career.

**Keywords:** Prediction, academic achievement, literature review, Education.

### Predição do Desempenho Acadêmico por Variáveis Cognitivas e Socioemocionais: Revisão Sistemática da Literatura

### Resumo

O objetivo do estudo foi examinar a produção científica acerca da predição do desempenho acadêmico por variáveis cognitivas e socioemocionais mediante uma revisão sistemática da literatura envolvendo artigos empíricos. A busca foi realizada nas bases de dados SciELO, Pepsic e Portal de Periódicos Capes, sendo definido o período de 2008 a 2018. Vinte seis artigos, que atenderam aos critérios de inclusão

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Support: Pesquisa financiada pelo Conselho Nacional de Desenvolvimento Científico e Tecnológico (Cnpq) através de bolsa de doutorado concedida à primeira autora.

pré-estabelecidos, foram analisados. A inteligência foi a variável mais frequente nos estudos ( $n=7$ ) e explicou de 1,21% a 43% do desempenho escolar. Algumas variáveis socioemocionais apresentaram poder preditivo superior ao da inteligência: autorregulação (49 a 90%), satisfação com o processo de aprendizagem (79,21%), autoeficácia (2,56 a 44,89%) e envolvimento com a aprendizagem (6,76 a 44,89%). A literatura revisada permite concluir que o desempenho acadêmico é multideterminado, tendo sido identificadas influências de distintas variáveis cognitivas e socioemocionais. Aponta-se a necessidade de estudos futuros considerarem a utilização de medidas padronizadas de desempenho que possibilitem maior comparabilidade dos dados, bem como a necessidade da construção de modelos de múltiplas variáveis e suas correlações para uma investigação mais profunda dos impactos dessas relações sobre o desempenho ao longo da trajetória escolar.

**Palavras-chave:** Predição, desempenho acadêmico, revisão de literatura, Educação.

## Predicción del Desempeño Académico por Variables Cognitivas y Socioemocionales: Revisión Sistemática de la Literatura

### Resumen

El objetivo del estudio fue examinar la producción científica acerca de la predicción del desempeño académico por variables cognitivas y socioemocionales mediante una revisión sistemática de la literatura envolviendo artículos empíricos. La búsqueda fue realizada en las bases de datos SciELO, Pepsic y Portal de Periódicos Capes, siendo definido el período de 2008 a 2018. Veinte seis artículos que atendieron a los criterios de inclusión preestablecidos fueron analizados. La inteligencia fue la variable más frecuente en los estudios ( $n=7$ ) y explicó del 1,21% al 43% del desempeño escolar. Algunas variables socioemocionales presentaron poder predictivo superior al de la inteligencia: autorregulación (49 a 90%), satisfacción con el proceso de aprendizaje (79,21%), autoeficacia (2.56 a 44.89%) e implicación con el aprendizaje (6.76 a 44.89%). La literatura revisada permite concluir que el desempeño académico es multideterminado, habiendo sido identificadas influencias de distintas variables cognitivas y socioemocionales. Se plantea la necesidad de que futuros estudios consideren la utilización de medidas estandarizadas de desempeño que posibiliten comparar los datos, así como la necesidad de construcción de modelos de múltiples variables y sus correlaciones para una investigación más profunda de los impactos de esas relaciones sobre el desempeño a lo largo de la trayectoria escolar.

**Palabras clave:** Predicción, desempeño académico, revisión de literatura, Educación.

An important research agenda at the interface of the psychological sciences with education is the investigation of the factors that predict and influence students' academic achievement. Despite the lack of consensus about the definition of academic achievement, it is usually studied through school grades, standard tests, national tests or assessments made by teachers (Costa, 2018). For a long time there was a prevalence of studies about the impact of intelligence on school grades. Researchers indicated that intelligence was able to explain between 25% and 50% of the variance

in students' school achievement (Deary, Strand, Smith, & Fernandes, 2007; Gagné & St. Père, 2002; Naglieri & Bornstein, 2003). Those results lead some researchers to argue that intelligence was the only relevant psychological construct in predicting academic achievement (Gottfredson, 2002a, 2002b; Kuncel, Hezlett, & Ones, 2004), restricting the contribution of other cognitive and socio-emotional variables in the educational environment. More recent research confirms the importance of intelligence for good achievement, indicating that it accounts for between 4 and 56.2% of the variance in academic achievement

(Downey, Lomas, Billings, Hansen, & Stough, 2014; Primi, Ferrão, & Almeida, 2010; Van der Stel & Veenman, 2008; Zuffianò et al., 2013).

However, beyond intelligence, socio-emotional and cognitive factors have been increasingly highlighted as relevant to academic achievement. In the literature, studies are identified about the role of variables such as well-being, metacognition, learning approaches, self-concept, self-esteem, self-efficacy and value assigned to the school as favoring motivation, engagement, persistence, task involvement and learning (Araujo & Almeida, 2014; Berger, Alcalay, Torretti, & Milicic, 2011; Gomes, 2010; Monteiro, Almeida, & Vasconcelos, 2012; Piran, 2014; Richardson, Abraham, & Bond 2012; Trautwein & Möller, 2016; Valentini & Laros, 2014). As Santos and Primi (2014) indicate, there is a growing understanding that traditional academic skills and a strict focus on knowledge acquisition are no longer sufficient for the student's academic, professional and personal success. The student best suited to the challenges of the school context presents intellectual and academic as well as affective and social competences. These two complementary dimensions reinforce one another (Araujo & Almeida, 2014).

Supporting these arguments, recent studies that aimed at identifying the role of various psychological dimensions on academic achievement indicate that variables such as metacognition, self-efficacy, self-esteem and self-concept, for example, play an important or even greater role than intelligence in explaining the variance of academic achievement (Araujo & Almeida, 2014; Piran, 2014; Rahmani, 2011; Van der Stel, Veenman, Deelen, & Haenen, 2010). Richardson et al. (2012) developed a meta-analysis of 217 studies with undergraduate students and found that self-efficacy was able to account for almost half of the variance in academic achievement (44.9%). Van der Stel et al. (2010) conducted a research with 59 high school students in which metacognition explained as much as 60.8% of the variance in students' grades. In a study involving 24,605 students in the fifth year of primary school and in the first and

third year of secondary school, Santos and Primi (2014) identified that the set of socio-emotional variables (conscientiousness, extroversion, emotional stability, locus of control, kindness and openness to new experiences) were more associated with achievement when compared to individual characteristics (age, race and sex), characteristics of the family environment (parental level of education, socioeconomic situation, among others) and attitudes of parents and children (regarding reading frequency and study support).

In recent decades, there seems to have been a paradigm shift about the prediction of academic achievement: from the predominance of research on the role of intelligence to the analysis of the influence of other personal variables on the students' trajectory. Therefore, the purpose of this study was to examine, through a systematic literature review, the scientific production of empirical articles in the last ten years, in order to verify the role of cognitive and socio-emotional variables in the prediction of the academic achievement of students from different levels of schooling.

## **Method**

This study involved a systematic literature review, in which the scientific publications of a given area or subject are investigated, using pre-established methods, in order to obtain a comprehensive and unbiased picture of the publications. The search criteria, study selection and data synthesis are presented, allowing other researchers to replicate the procedure (Galvão & Pereira, 2014). The procedures used to elaborate this study are explained as follow.

### **Search Procedures**

The search for the articles took place in February 2018, consulting three Brazilian databases that offer texts published in Brazilian and international scientific journals, namely: Journal Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES), Scientific Electronic Library Online (SciELO) and Electronic Journals in Psychology

(PePSIC). The following pairs of descriptors were used: *predição* and *desempenho acadêmico*, predictive model and academic achievement, *modelagem por equação estrutural* and *desempenho acadêmico*, *modelagem por equação estrutural* and *rendimento escolar*, *modelagem por equação estrutural* and *desempenho escolar*, *predição* and *rendimento escolar*, *predição* and *desempenho escolar*, structural equation modeling and academic achievement. In the CAPES Journal Portal, in particular, the option only scientific articles was selected, as well as the filter papers published in peer-reviewed journals. The other databases publish only peer-reviewed articles, not requiring such a filter. Still, in relation to the search carried out in the CAPES Journal Portal, when using the descriptors predictive model and academic achievement, due to the high number of articles found and aiming to refine the search to identify researches more pertinent to the study purpose, the filter psychology was added. The search period was restricted to empirical articles published in the last ten years.

### *Paper Selection Procedures*

One hundred and thirty five articles matched the search criteria. Regarding the distribution by database, most articles came from the CAPES Portal (113 articles, 83.7%), followed by Scielo (21 articles, 15.55%). Only one article (0.74%) was identified in Pepsic Journal Portal. In an initial analysis, 33 articles were excluded due to duplication. For the remaining 102 papers, the abstracts were read and evaluated according to their relevance to the study, considering the following inclusion criteria: (a) published in a peer-reviewed journal, (b) published between 2008 and 2018, (c) investigates the prediction of students' academic achievement, (d) using learners' cognitive and/or socio-emotional variables in the predictive analysis, and (e) employing quantitative data analysis. Thirty-one articles that seemed to fit the research criteria were pre-selected and fully read. During the reading process, five of them did not meet the previously established inclusion criteria and were withdrawn from the analysis. Thus, the

study involved the analysis of 26 empirical articles published in Brazilian or international peer-reviewed journals, which investigated the predictive role of cognitive and/or socio-emotional variables in students of different educational levels.

### *Article Analysis Procedures*

Initially, the selected articles were characterized regarding the year of publication, language of publication of the article, institution and country of affiliation of the authors, country of data collection and type of authorship. Descriptive statistics (frequency and percentage) were used to establish the general characteristics, aiming to identify the panorama of the selected publications. The articles were also described regarding the academic achievement measure used as a criterion and the study sample. Afterwards, the study results were analyzed with regard to achievement prediction by cognitive and socioemotional characteristics – the variables studied and their predictive power of academic achievement. Some articles included the investigation of the role of socioeconomic, demographic, previous academic achievement variables, among others, in the prediction of achievement. As this study focuses on students' cognitive and socio-emotional variables, only the results referring to those variables were considered. Correlation ratios were transformed into percentage of variance explained for standardization and better understanding of the results.

## **Results**

Regarding the year of publication, 2015 concentrated the highest frequency of publications with six articles (23.08%), followed by 2012 and 2014 with five publications each (19.23%). In 2008, 2011, 2016 and 2017, two articles were published annually (7.69%). In 2009 and 2010, only one publication per year was found (3.85%). Based on the search and selection criteria, we did not identify publications in 2013 and 2018. The absence of publications from 2018 can be explained by the fact that the search occurred in February of that year.

The predominant language of the publications was English, in which 12 of the 26 papers analyzed (46.15%) were written, followed by Portuguese with 11 (42.31%) papers. Three articles were written in Spanish (11.54%). As far as authoring type is concerned, there is a strong predominance of multiple authorship, as only two articles were published by a single author (7.69%). Most articles were written by two ( $n = 8$ ; 30.77%), three ( $n = 5$ ; 19.23%) or four authors ( $n = 5$ ; 19.23%). Four publications were authored by five authors (15.38%) and two by six authors (7.69%). Four of the selected articles reflected international partnerships, considering the institutional affiliation of the authors: two articles were published through partnerships between authors from Brazilian and Portuguese institutions, one resulted from the cooperation between authors of Spanish and English institutions and one study reflected collaboration between institutions in three countries: Spain, Portugal and Brazil.

Regarding the country of study, a predominance of Brazilian studies ( $n = 10$ ; 38.46%) was observed, followed by work done in the United States ( $n = 4$ ; 15.38%). Two studies (7.69%) were conducted in Spain and in Portugal. One study (3.85%) was carried out in each of the following countries: Argentina, Belgium, Canada, Italy, Lebanon, Macedonia, Slovênia and Uruguay. If we consider only the number of Brazilian and international articles, the former corresponded to 38.46% of the sample while 61.54% were international articles. The target population of the studies was varied with samples of all school levels. The most frequent level of education was primary education, investigated in 18 of the 26 articles selected (52.94%). Secondary education and higher education were investigated in seven (20.59%) and five studies (14.71%), respectively. Early childhood education was the least examined target audience, involving only four articles (11.76%). Eight articles simultaneously studied more than one educational level.

The articles selected for this study are characterized in Tables 1 and 2, describing the

authors, sample size, sample level of schooling and academic achievement measure used. Table 1 shows the selected Brazilian studies and Table 2 the international studies. A large variation in sample size is observed, such as the study by Bandeira, Costa and Arteché (2008), that presented the lowest number of participants ( $n = 90$ ), and Partin and Haney (2012) with the largest number of participants ( $n = 20,300$ ).

As to the achievement measures used in the studies, most of the studies ( $n = 18$ , 69.23%) used school grades as an indicator of students achievement. Four studies evaluated achievement using psychometric tests (Bandeira et al., 2008; Marturano & Pizato, 2015; Marturano et al., 2009; Pinto, Bigozzi, Tarchi, Vezzani, & Gamannossi, 2016). Four other studies used standard educational measures on a large scale: a Brazilian study used the grades on the *Provinha Brasil*, a national test developed by the government to assess educational quality, to evaluate the achievement of primary school students (Correia-Zanini et al., 2016); a study carried out in Slovenia, based itself on the grades of the Slovenian National Examination (NET) for the evaluation of primary school students (Levpušček, Zupancic, & Socan, 2012); a Canadian study used the Canadian government's standard achievement test to measure the achievement of primary school students (Oberle, Schonert-Reichl, Hertzman, & Zumbo, 2014); and an American study evaluated the achievement of secondary school students based on the Virginia Learning Pattern (Zimmerman & Kitsantas, 2014).

The results of the prediction of academic achievement found in the 26 articles analyzed in this study are described in Table 3 in alphabetical order of the research variables. Only statistically significant results from each study explaining the variance of academic achievement by more than 1% were included in this table. In the variables listed, two refer to categories created to combine the results of similar observable variables: (a) learning engagement behaviors, which refer to the indicators of class participation, discipline, commitment, classroom adjustment

**Table 1**  
**Characteristics of Brazilian Papers in the Study by Sample and Performance Measure**

	Authors	Participants	School level	Performance Assessed
1	Bandeira et al. (2008)	90	Child and primary	School Performance Rating Scale (teacher assessment of student learning and behavior)
2	Correia-Zanini, Marturano, & Fontaine (2016)	186	Primary	<i>Provinha Brasil</i>
3	Gomes (2011)	684	Primary and secondary	Equalized annual performance (Mathematics, Portuguese, history and geography)
4	Gomes & Golino (2012)	684	Secondary	School grades
5	Marturano & Pizato (2015)	248	Primary	Joint Assessment of Portuguese and Mathematics and Academic Competency Scale of Social Skills Rating System - SSRS-BR
6	Marturano, Trivellato-Ferreira, & Gardinal (2009)	171	Primary	School Performance Test (Reading, writing and arithmetic)
7	Mecca, Jana, Simões, & Macedo (2015)	213	Child and primary	Arithmetic test
8	Muniz & Nascimento (2014)	177	Primary	General performance (grades on Portuguese, mathematics, history, geography and science)
9	Muniz, Seabra, & Primi (2015)	317	Primary	School grades
10	Noronha & Lamas (2014)	280	Higher	Academic performance (academic performance ratio, satisfaction with performance and score assigned to academic performance)

and responsibility; and (b) behaviors associated with the lack of commitment to learning, which included the results regarding attitudes such as missing class, indiscipline and not completing the homework.

The intelligence variable listed in Table 3 groups the different measures of intelligence investigated in the studies, namely: general intelligence, fluid intelligence, numerical reasoning, verbal reasoning and visualization. Likewise, the variable learning strategies refers to the results of kinesthetic/tactical, metacognitive, personalized, reading/writing strategies, among others. The school stress variable grouped the following indicators: school stressors related to achievement, the family-school relationship, the relationship with peers, adaptation, general stress due to school, and tensions related to the

student's role. The variance explained results in Table 3 that are underlined indicate a negative correlation of that variable with achievement.

The most investigated variable was intelligence, being the focus of seven studies and responsible for explaining 1.21% to 43% of the variance in students' school achievement (Bandeira et al., 2008; Bossaert et al., 2011; Gomes & Golino, 2012; Lemos et al., 2008; Levpušcek et al., 2012; Mecca et al., 2015; Vilia et al., 2017). Next, self-efficacy and learning engagement behaviors were the most frequent variables with five studies each. Self-efficacy explained from 2.56 to 44.89% of the variance in academic achievement (Cupani, 2010; Levpušcek et al., 2012; Partin & Haney, 2012; Vilia et al., 2017; Zimmerman & Kitsantas, 2014). The learning engagement behaviors

**Table 2**  
**Characteristics of International Papers in the Study by Sample and Performance Measure**

	Authors	Participants	School Level	Country	Performance Assessed
11	Ayyash-Abdo & Ruiz (2012)	1,401	Higher	Lib	Mean school grades
12	Bossaert, Doumen, Buyse, & Verschueren (2011)	153	Child and primary	Bel	General performance (language and mathematics)
13	Busquets, Pros, Muntada, & Martín (2015)	391	Secondary	Spa	Mean school grades
14	Casillas et al. (2012)	4,660	Primary	Usa	Mean school grades
15	Cupani (2010)	420	Primary	Arg	School performance on mathematics
16	Iniesta, López-López, Corbíl, Pérez, & Costa (2017)	1,398	Primary and secondary	Spa	Mean school grades
17	Lemos, Almeida, Guisande, & Primi (2008)	4,899	Primary	Por	Teacher-assigned Academic grades
18	Levpušcek et al. (2012)	416	Primary	Svn	School grade on mathematics and mathematics grade on Slovenian National Test (NET)
19	Oberle et al. (2014)	461	Primary	Can	Standard performance test of Canadian government
20	Partin & Haney (2012)	20,300	Higher	Usa	Standard course grades
21	Pinto et al. (2016)	202	Child and primary	Ita	Mathematics Competency measured by Objective Mathematics Test for primary school
22	Rodriguez-Ayan & Rico (2015)	218	Higher	Ury	Relation between courses passed and courses taken and relation between tests passed and tests taken
23	Vasileva-Stojanovska, Malinovski, Vasileva, Jovevski, & Trajkovik (2015)	142	Primary	Mkd	Teacher assessment
24	Vela et al. (2014)	166	Higher	Usa	Mean school grades
25	Vilia, Candeias, Neto, Franco, & Melo (2017)	470	Primary	Por	School grades on physics and chemistry
26	Zimmerman & Kitsantas (2014)	507	Secondary	Usa	Mean grades and Virginia learning standard (mathematics, reading and writing performance)

**Table 3**  
**Identified Variables and Their Role in the Variance Explained of Academic Performance**

Variable	Variance explained of Academic Performance	Studies
Deep learning approach	1.96% to 8.64%	3 and 4
Superficial learning approach	6.76%	3
Negative affect	<u>10.43</u> to <u>12.46</u> %	25
Positive affect	1.12 to 1.69%	11 and 25
Self-concept	2.95 to 19.71%	8
Self-efficacy	2.56 to 44.89%	15, 18, 20, 25 and 26
Self-regulation (self-efficacy + responsible learning + self-regulated learning + motivated learning strategies)	49 to 90%	26
Personality characteristics		
Openness	4.41 to 7.29%	18
Self-control	5.29 to 15.21%	26
Externalization	<u>10.24</u> to <u>17.64</u> %	5
Extroversion	<u>3.38</u> to <u>8.41</u> %	18
Impulsiveness	6.76 to 17.64%	26
Internalization	9 to <u>17.64</u> %	5
Neuroticism	1.06%	23
Reading competency	5.15 to 41.73%	8
Behaviors associated with lack of commitment to learning (absence, indiscipline, not completing homework)	<u>4.84</u> to <u>17.9</u> %	13, 14
Learning engagement behavior (participation, discipline, commitment, classroom adjustment, responsibility)	6.76 to 44.89%	12, 6, 10 and 26
Learning strategies	1.36% to 38.44%	16, 23 and 26
School stress	1.21 to <u>22</u> %	2, 5 and 6
Social and socioemotional skills	5.33 to 23.04%	5 and 19
Intelligence	1.21 to 43%	1, 12, 4, 17, 18, 7 and 25
Interest	1.88 to 3.88%	22
Metacognition	5.76 to 18.49%	14, 16 and 21
Performance targets	7.29%	15
Social responsibility targets	1.34 to 5%	19
Intrinsic goal orientation	1.50%	20
Perceived parental expectations	<u>1.69</u> to 14%	16 and 18
Perceived parental support	<u>1.21</u> to 4.8%	16 and 18
Learning potential	6.25 to 18.49%	9
Satisfaction with learning process	79.21%	23
Value assigned to school	2.01 to 14.2%	20, 22 and 25



contributed between 6.76 and 44.89% to the variance in the students' achievement (Bossaert et al., 2011; Marturano et al., 2009; Noronha & Lamas, 2014; Zimmerman & Kitsantas, 2014).

Learning strategies, stressors related to the school environment, metacognition and value attributed to the school were investigated in three studies each. We identified that learning strategies explained 1.36% to 38.44% (Iniesta et al., 2017; Vasileva-Stojanovska et al., 2015; Zimmerman & Kitsantas, 2014). Each study focused on a different type of learning strategy. Thus, the variation in the explanation of achievement may be due to the difference in the effect of each of the strategies on the school trajectory. School stress contributed between 1.21 and 22% to the explanation of the achievement variance (Correia-Zanini et al., 2016; Marturano & Pizato, 2015; Marturano et al., 2009). In most studies, the correlation was negative, indicating a detrimental effect of stress on achievement. There were also observed positive correlations between stressors and academic achievement though, indicating that, in some cases, stress may contribute to the achievement. Metacognition was responsible for 5.76 to 18.49% of the variance in academic achievement (Casillas et al., 2012; Iniesta et al., 2017; Pinto et al., 2016). The value assigned to the school explained between 2.01 and 14.2% of the variance in the academic achievement (Partin & Haney, 2012; Rodriguez-Ayan & Rico, 2015; Vilia et al., 2017).

Other variables, even though they have been the focus of only one or two studies, stand out by their power to contribute to explaining the variance of academic achievement: self-concept (2.95 to 19.71%), self-regulation (49 to 90%), reading competence (5.15% to 41.73%), behavior associated with lack of commitment to learning (4.84 to 17.9%), social skills (5.33 to 23.04%), learning potential (6.25 to 18.49%), and satisfaction with the learning process (79.21%) (Busquets et al., 2015; Casillas et al., 2012; Marturano & Pizato, 2015; Muniz & Nascimento, 2014; Muniz et al., 2015; Oberle et al., 2014; Vasileva-Stojanovska et al., 2015; Zimmerman & Kitsantas, 2014). It is relevant to

highlight that the correlations found between the behaviors associated with the lack of commitment to learning and academic achievement were negative, that is, the greater the student's lack of commitment to the school context, the lower his grades were. Self-regulation, which explained up to 90% of the variance in academic achievement in the study by Zimmerman and Kitsantas (2014), consisted of self-efficacy, responsible learning, self-regulated learning and motivated learning strategies combined, thus justifying its great explanatory power.

## **Discussion**

The aim of this study was to examine the scientific production of empirical articles in the past ten years about the role of cognitive and socio-emotional variables in the prediction of academic achievement through a systematic literature review. In total, 26 articles that met the pre-established selection criteria were identified and analyzed. Regarding the state of the art of this theme, we highlight the significant contribution of the Brazilian production, as 38.46% of the selected articles were conducted in Brazil, where the largest number of publications was found ( $n = 10$ ). This may reflect the fact that, despite the use of descriptors in Portuguese and English, the bases of the study were predominantly Brazilian. In future studies, we suggest including international bases for the sake of a more precise verification of the extent of the contribution of Brazilian research to this theme. In any case, there is considerable production about the investigation of cognitive and socio-emotional variables and their effect on the academic achievement in the Brazilian scenario.

As for the target audience, there is a lack of research involving early childhood education, with only 11.76% of the total number of articles found. One possible explanation is that this school stage is characterized by more flexible and procedural school achievement measuring (Both & Martins, 2016; Sousa, 2014), usually not characterized by tests or other quantitative measures, which limits the possibilities of

predictive research. Aiming for a better understanding of the role of each of the cognitive and socio-emotional variables in each stage of schooling, however, we recommend expand the studies for these age groups, keeping in mind the educational characteristics of each stage.

One gap identified in the literature is the difficulty to compare the research results, due to the different academic achievement measures used. Most articles ( $n = 18$ ; 69.23%) used school grades as parameters for measuring students' academic achievement. The criteria for these evaluations are strongly influenced by the characteristics of the teacher, the school, specific characteristics of the evaluation, etc. though, generating results of low external validity. In future studies, we suggest using: (a) academic achievement measures taken from psychometric tests, such as those used in the studies by Bandeira et al. (2008), Marturano and Pizato (2015), Marturano et al. (2009), Pinto et al. (2016); or, when appropriate, (b) large-scale achievement measures that allows a national or international comparability of research data, such as the studies by Correia-Zanini et al. (2016), Levpušček et al. (2012), Oberle et al. (2014) and Zimmerman and Kitsantas (2014). In the case of Brazil, for example, there are several national academic achievement assessments of the different educational levels, such as the Basic Education Development Index (IDEB; National Institute of Educational Studies and Research Anísio Teixeira [INEP], 2016a), the *Prova Brasil* (Federal Education Department [MEC], n.d.), the *Provinha Brasil* (MEC, 2015a), the National Student Achievement Examination (MEC, 2015b) and the National Secondary School Examination (MEC, 2015c). These measures provide achievement indicators that permit the comparability of results from different regions of the country. Therefore, we suggest that future Brazilian research seeks the possibility to associate nationally standardized achievement measures to already established academic achievement measures. Internationally, we identify, for example, the existence of the PISA, the Programme for International Student Assessment. The

assessment, held every three years, measures the educational level of 15-year-old students based on three knowledge areas: science, reading and mathematics, and contextualizes the results by applying questionnaires to the students, school principals, parents and teachers (INEP, 2016b). In 2015, the PISA was applied in more than 70 countries (*Organização para Cooperação e Desenvolvimento Econômico* [OECD], 2015), producing academic achievement indicators that, if adopted in future research, will allow the international comparability of the research results. The issue of data comparability refers not only to the academic achievement measures, but also to the assessments of the cognitive and socio-emotional characteristics. We have found that, sometimes, the same variable is investigated in different studies with distinct names.

Regarding the prediction of achievement by cognitive and socioemotional characteristics, the predominance of research on the role of intelligence is still observed, as this is the variable that appears most frequently ( $n = 7$ ). However, due to the range of cognitive and socio-emotional variables investigated in the articles under analysis we verify that the notion that only intelligence plays a predictive role in academic achievement is outdated. In this sense, some socio-emotional variables presented greater predictive power than intelligence as self-regulation (49 to 90%), satisfaction with the learning process (79.21%), self-efficacy (2.56 to 44.89%) and learning engagement behaviors (6.76 to 44.89%). Hence, according to the literature, academic achievement is multidetermined, with influence from cognitive and socio-emotional variables, particularly intelligence, metacognition, self-regulation, self-efficacy, self-concept, satisfaction with school, level of engagement, learning strategies and social skills. Thus, we assumed, based on the literature review, that the development of these characteristics in the students could be a way to boost their school trajectory and favor their achievement. Most research ( $n = 20$ , 76.92%) investigated the variables in isolation, as well as their correlation with achievement or the analysis of linear regressions, which do

not allow the investigation of mutual relations among the variables. Some of the studies ( $n = 6$ ) went beyond the objective of this article about the direct prediction of academic achievement and also investigated the relationships between some variables and how that interaction would interfere in the explanation of academic achievement (Bossaert et al., 2011; Gomes & Golino, 2012; Iniesta et al., 2017; Levpušcek et al., 2012; Partin & Haney, 2012; Zimmerman & Kitsantas, 2014). Gomes and Golino (2012), for example, analyzed the relationship between intelligence and learning approach in the prediction of academic achievement. The authors tested whether intelligence explains the achievement mediated by approaches to learning or whether, in the opposite sense, the influence of approaches to learning on achievement is indirect, through intelligence. The lack of a hierarchical relationship between approaches to learning and intelligence was identified, indicating that both influence academic achievement independently, but without a mutual causal relationship. The study by Gomes and Golino, for example, represents a forward path in research on achievement prediction. This type of analysis enables, beyond the study of the individual influence of the variables on the students' grade, the investigation of how each of the variables interacts mutually, and can signal new understandings on how to enhance the students' school trajectory. This conclusion is in line with the literature propositions about the need to construct multi-variable models and their relationships in explaining academic achievement (Araujo & Almeida, 2014; Richardson et al., 2012).

In short, the results presented here point out that academic achievement is multidetermined, with influences of different cognitive and socioemotional variables on the students' achievement. The increased ability to self-regulate one's cognition and learning, higher levels of reasoning, more positive self-beliefs, greater involvement with the school environment, less stress, and higher levels of satisfaction with life seem to favor academic achievement. The main limitations identified in

the literature relate to the non-comparability of the measures used in the different studies, as well as the lack of research investigating the relation of the different variables in the explanation of achievement, indicating the need to construct multiple variable models and their correlations for a more in-depth investigation of how the variables influence one other in favor of the school trajectory. As limitations of this study, we point out: (a) the restriction of the search to scientific articles only, excluding other types of publications such as master's theses, doctoral dissertations, and books; (b) the review of the literature considering the distinct procedures established by the authors; and (c) the selection of keywords that may have limited the number of articles found. In this sense, for future research, we suggest expanding the keywords in order to increase the number of articles identified, as well as using pre-established literature review protocols such as PRISMA (Galvão, Pansani, & Harrad, 2015), in order to add more data to those found in this research about the prediction of academic achievement by means of cognitive and socio-emotional variables.

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*Received: 29/04/2018*  
*1ª revision: 26/11/2018*  
*Accepted: 11/12/2018*